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BIKE

STUDY

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An analysis of existing bike use, projected needs and potential design. A bike system proposal is included with specific design considerations examining traffic volumes, origin-destination points, road conditions, alternate systems, route-path design, design costs and potential funding sources. Also contained in this study is a discussion of methods encouraging bike usage by providing parking facilities, limiting thefts and loss, and fostering bike safety.

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LANDIS BIKE STUDY

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LANDIS BIKE STUDY

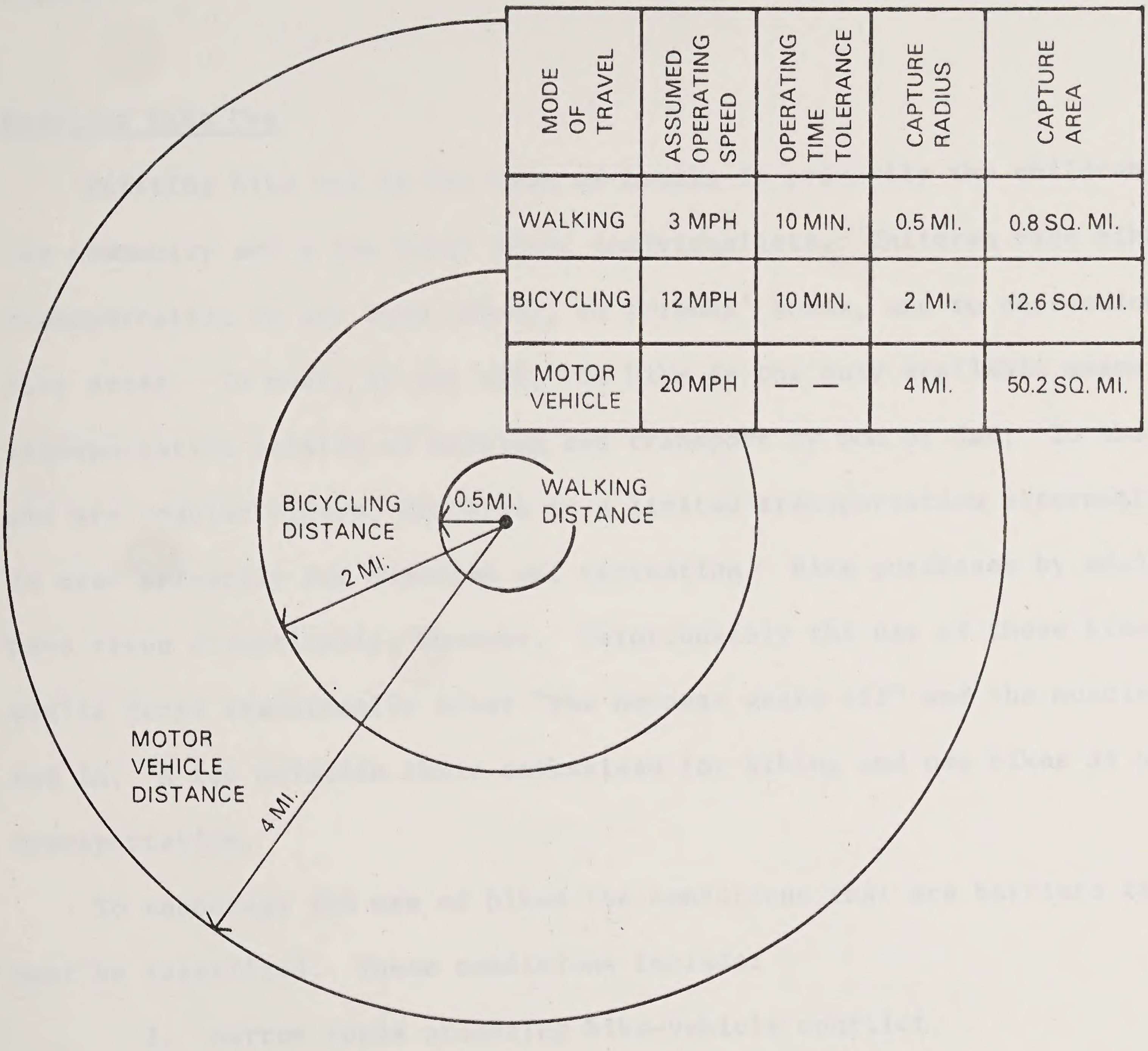
PART I

Preamble

Peddling the two wheeler for fun and relaxation or for cheap transportation has strongly increased in popularity over the past few years. Few adults have forgotten the excitement of their first bike, though a shaky and strenuous ride around the block on junior's bike recalls the ravages of age. Increasingly, Americans of all ages have returned to peddle power. The early 70's raised interest in transportation that was environmentally harmless and healthwise profitable. Recently the high cost of gasoline has produced an enthusiasm for the transit that runs merely on perspiration and grunts.

Adults are quickly learning what the youngsters have known all along, bikes and cars don't get along. Our society over the past three decades has become dominated by the motor vehicle. Even in our own local communities the corridors of non-automobile movement have virtually disappeared. Residential sidewalks, particularly in more recent developments, have almost vanished. The individual who desires to push a peddle knows too well that his safety and welfare are largely up to the courtesy and fast reflexes of the car driver.

As more adults have returned to bike travel the demand for safer routes has become more vocal. A 1975 questionnaire to the residents of Landis indicated an overwhelming concern for safe bike routes. This town of over 2,000 people in South Rowan County has a history of concern for the well-being and recreation of its residents. Strong support for recreation and education through local government, civic organizations and industry is indicative of this concern, particularly for the youth.



MODE OF TRAVEL	ASSUMED OPERATING SPEED	OPERATING TIME TOLERANCE	CAPTURE RADIUS	CAPTURE AREA
WALKING	3 MPH	10 MIN.	0.5 MI.	0.8 SQ. MI.
BICYCLING	12 MPH	10 MIN.	2 MI.	12.6 SQ. MI.
MOTOR VEHICLE	20 MPH	— —	4 MI.	50.2 SQ. MI.

A COMPARISON OF PEDESTRIAN, MOTOR VEHICLE, AND BICYCLE TRAVEL TIMES

SOURCE: The North Carolina Bike Facility and Program Handbook

The questionnaire results not only projected the need for safety but also the desire to make bike riding an enjoyable form of recreation and transportation for all its citizens. This study is in response to these interests and is intended to provide a plan and means of implementation for safer bike travel, a feasible transportation alternative, and recreational enjoyment.

Existing Bike Use

Existing bike use in the Town of Landis is primarily the children of the community and a few hardy adult individualists. Children ride bikes for transportation to and from school, to friends' homes, and to recreation or play areas. To most, if not all, the bike is the only available means of transportation outside of walking and transport by mom or dad. To the adults who are regular riders, the bike is a limited transportation alternative or is used primarily for exercise and recreation. Bike purchases by adults have risen dramatically, however. Unfortunately the use of these bikes by adults drops dramatically after "the newness wears off" and the muscle aches set in. A few maintain their enthusiasm for biking and use bikes as primary transportation.

To encourage the use of bikes the conditions that are barriers to use must be identified. These conditions include:

1. narrow roads producing bike-vehicle conflict
2. heavy vehicle traffic
3. road designs that result in hazardous or difficult travel
   - a. storm sewer grates
   - b. pot holes and grade separations
   - c. steep grades
   - d. frequent stops

4. inconvenience due to
    a. slow movement
    b. motorist abuse
    c. existing routes that are not designed for reaching desired locations
5. limited recreation value
6. lack of parking facilities at destination points (e.g., shopping areas, schools, recreation areas)
7. weather conditions

With the exception of item 7, all the above can be alleviated by the development and implementation of a practical bike system plan.

Bike Users Survey

In order to acquire a better understanding of actual bike use, a questionnaire was developed and distributed at the municipal building and library, Corriher-Lipe Junior High School, Landis Elementary School, and South Rowan Senior High. 149 responses were received. Of these responses, 138 or 95.3 percent indicated bicycle ownership. Every area of the Town of Landis was represented by the respondents as indicated by the following streets of residence:

Zion St.
Rankin Rd.
Central Ave.
Correll St.
Ridge Ave.
Main St.
Turner St.
Limits Ave.
5th St.
Vance St.
Corriher St.
Chapel St.
Dial St.
Meriah St.
Garden St.
Hoke St.
Beaver St.
Kimmons
Valley
Upright St.
1st St.
B St.
Round St.
Taylor St.
Davis St.
Blume St.
Everhardt Dr.
Dogwood Ln.
Linn St.
Corriher Heights
Mills St.

Use of bikes, according to the questionnaire, was overwhelmingly for pleasure with 92.6 percent. Other categories of use included 17.5 percent for shopping, 14.1 percent for home to school travel, and 6.7 percent for

home to work or school to work. Interestingly, 42.3 percent of those surveyed traveled downtown by bike. 14.1 percent traveled to the park, 13.4 percent traveled to the junior high and 10.7 percent biked to the elementary school. Other locations listed as points of destination included:

high school
store
anywhere
tennis courts
pool
pavilion
friends
playground
parking lot
relatives
Kannapolis
dairy bar
church
library
woods
pond
post office
dirt roads

The above most mentioned places to bike were highly indicative of where people actually travel with their bikes.

Average trip length varied considerably depending upon age group. Elementary school students traveled the shortest distances, followed by respondents at the municipal building and library, primarily adults. Junior high students used bikes for longer trips. Senior high students indicated the longest trips. Trip length was highest in the pleasure category with a range of between two blocks to 15 miles. Home to school trips ranged from 2/10 mile to five miles. Shopping travel length was three blocks to two miles and home to school-home to work travel was one block to two miles.

The survey results indicated a strong relationship between street of residence and frequently traveled streets. Frequently traveled streets tended to be those streets within the immediate neighborhood of the respondent and the streets connecting the major destination points. These streets included:

Ridge St.
Rice St.
Main St. (29A)
Zion St.
Correll St.
Beaver St.
Ryder Ave.
5th St.
Cannon Farm Rd.
Coldwater St.
Limit Ave.
Poplar St.
Airport Rd.
Landis Rd.
Kimball
Chapel St.
Central Ave.
Mill St.
Upright St.
Dial St.
Kimmons St.
Hoke St.
Valley
Round St.
Blume St.
6th St.
Rankin St.
Mooresville Hwy.

The respondents listed numerous points of conflict between the cyclist and automobiles and problems of cycling. The most mentioned concerns were:

"careless and reckless automobile drivers"
"honking horns"
"cursing drivers"
"being run off the road"
"no room"
"where sidewalks end"
"narrow and steep shoulders"
"steep hills"
"intersections"
"stop lights and signs"
"no parking facilities downtown and other destinations"

These concerns are ones bikers themselves feel in Landis. They are the same problems enumerated in many communities lacking facilities for bike movement.

The time of day listed most frequently for bike use was the evening (61.7%), with mid-morning to late afternoon following at 50.4 percent. Respondents listed early morning only 14.1 percent.

A slight majority of the bikers in Landis (58.4%) travel outside the town limits. These bikers are generally taking longer pleasure trips on county secondary roads.

Of the 149 respondents, 85.2 percent (127) indicated they would use their bikes more if routes or pathways were established. Many of those who responded negatively to this question were either biking very little or biking everyday. Routes or pathways would make little difference to either group.

96.6 percent of the respondents said they had not registered their bikes with the Landis Police Department.

Frequency of bike use by the respondents (three or more days per week) was 67.8 percent. 16.1 percent of those questions indicated they had no set pattern of bike use but rode considerably in the summer. The remaining 16.1 percent rode less than three times per week.

Projected Needs and Design Use

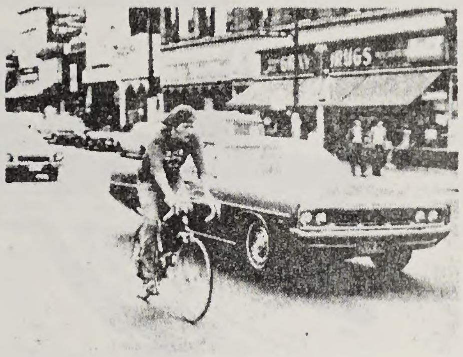
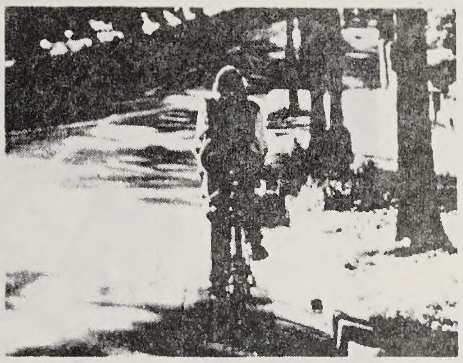
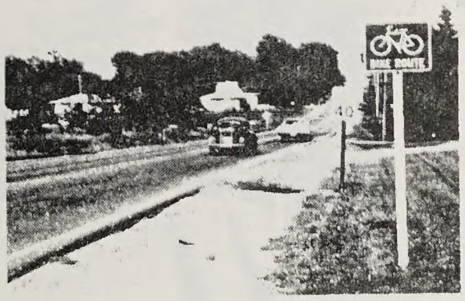
In projecting needs as a basic premise for the type of bike system required, the ultimate question is whether the design will be utilized for recreation only or whether the system will become a transportation corridor for bike users. Certainly children now riding are using their bikes for transport. Will they use a bike system, route or path, in lieu of short cuts along more hazardous streets? Will the adult be sufficiently encouraged by the bike system to ride a bike as an alternative to the motor vehicle? Both questions rely heavily on whether the system fulfills their need to travel with relative ease and convenience. If the system is utilized only for the annual bike-a-thons, then its effectiveness for transportation or recreation is practically nill.

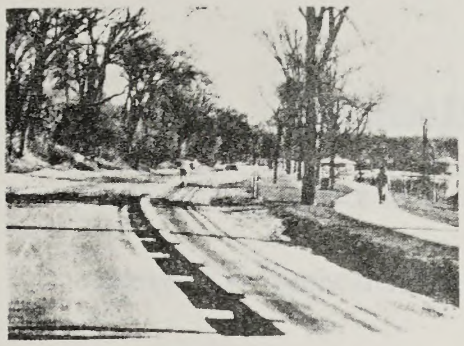
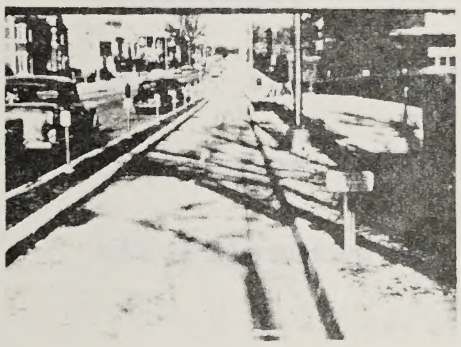
There are a variety of designs that can be utilized for bike travel. These include:

1. Bike Paths - Physically removed from the roadway this system is by far the safest. It is also useful because it can be designed to carry travel by points of environmental, aesthetic and recreational interest. This design is also useful in bypassing heavy traffic corridors and connecting major points of origin and destination more directly. The major drawback is the design cost.

2. Detached Bike Routes - This design is along or within the street right-of-way but separated from traffic by a physical barrier such as a median strip. This design allows bike travel to flow along the same corridors as motor vehicles. The major drawbacks are the extensive street alterations required, special treatment of intersections required, and the high cost.

BIKEWAY OPTIONS

Option	Other Frequently Used Terms	Description of Improvement	Degree of Separation from Motor Vehicles
Do Nothing 	--	Street with no special improvement, but good surface and increased maintenance	None
Lane Widening 	--	Curb lane widened, street surface improved, increased maintenance	De facto operational separation
Bike Route 	Class III	Road signed for bicycling but with motorists and bicyclists sharing road surface	None
Bike Lane (unprotected) 	Class II	A striped lane for exclusive or semi-exclusive bicycle use	Symbolic separation

Option	Other Frequently Used Terms	Description of Improvement	Degree of Separation from Motor Vehicles
Bike Lane (protected) 	Class II	A lane for exclusive or semi-exclusive bicycle use separated by physical barrier	Structural separation
Sidewalk path 	--	Sidewalk designated for bicycle use	Structural separation from motor vehicles but shared surface with pedestrians; limited environmental separation
Bike Path (within street right-of-way) 	Class I	Bike path set off-street with intervening land area	Structural separation; limited environmental separation
Bike Path (independent) 	Class I	Path designated for exclusive or semi-exclusive bicycle use completely separated from street right-of-way	No relationship to motor vehicle environment

SOURCE: The North Carolina Bike Facility and Program Handbook

3. Sidewalk Bike Routes - This design utilizes sidewalks as corridors for movement. It physically separates bikes from motor vehicles. However, it produces a paradoxical conflict between the biker and the pedestrian unless sidewalks are restricted for each type of use. The design requires special treatment of curbs at street crossings. Because Landis has few sidewalks, a major sidewalk program could be initiated only at a high cost.

4. Designated Bike Lanes - This design would designate corridors along existing streets and separate traffic by markings on the street. The movement is psychologically separated. However, this design relies on sufficient road surface width to develop a separate lane. The vast majority of streets in the Town of Landis do not have adequate width unless on-street parking was prohibited or indicated streets were designated for one-way traffic only.

5. Bike Route or Safeway - This design utilizes existing local streets with on-street movement. The streets are selected for their low traffic volume, convenience to selected destinations, and least hazardous intersection crossings. This design is the most easily implemented but is also the least safe. If implemented the design should be studied periodically to assure that motor vehicle use has not drastically increased, thus reducing the effectiveness as a "safeway."

Though not enumerated in the above list, there is another alternative--undesignated bike movement. Perhaps this could be termed as an undesign. The undesignated form is movement which exists in most communities. Even with the best bike system the cyclist is bound to use the undesignated streets for movement. The intent of this study is to limit that use to the greatest extent possible, especially to the unskilled and inexperienced riders.

From a practical standpoint a community the size of Landis would have difficulty in financing major street alterations and improvements. The system which appears to be most feasible at this time is a combination of bike routes and limited bike paths.

The bike route is an area designated on local streets for use by the cyclist. Its primary purpose is to direct bike traffic to the safest streets and inform motorists of the presence of cyclists. Though the route is planned for maximum safety, it is far from hazard free. Whenever a bike and a motor vehicle travel together the possibility of an accident exists.

Bike paths are designed for cross-country cycling and for scenic and recreational quality. Because of their separation from the street it is the safest design, but it will go unused unless the path leads to points of interest or potential destination.

PART II

BIKE SYSTEM PLAN

Introduction

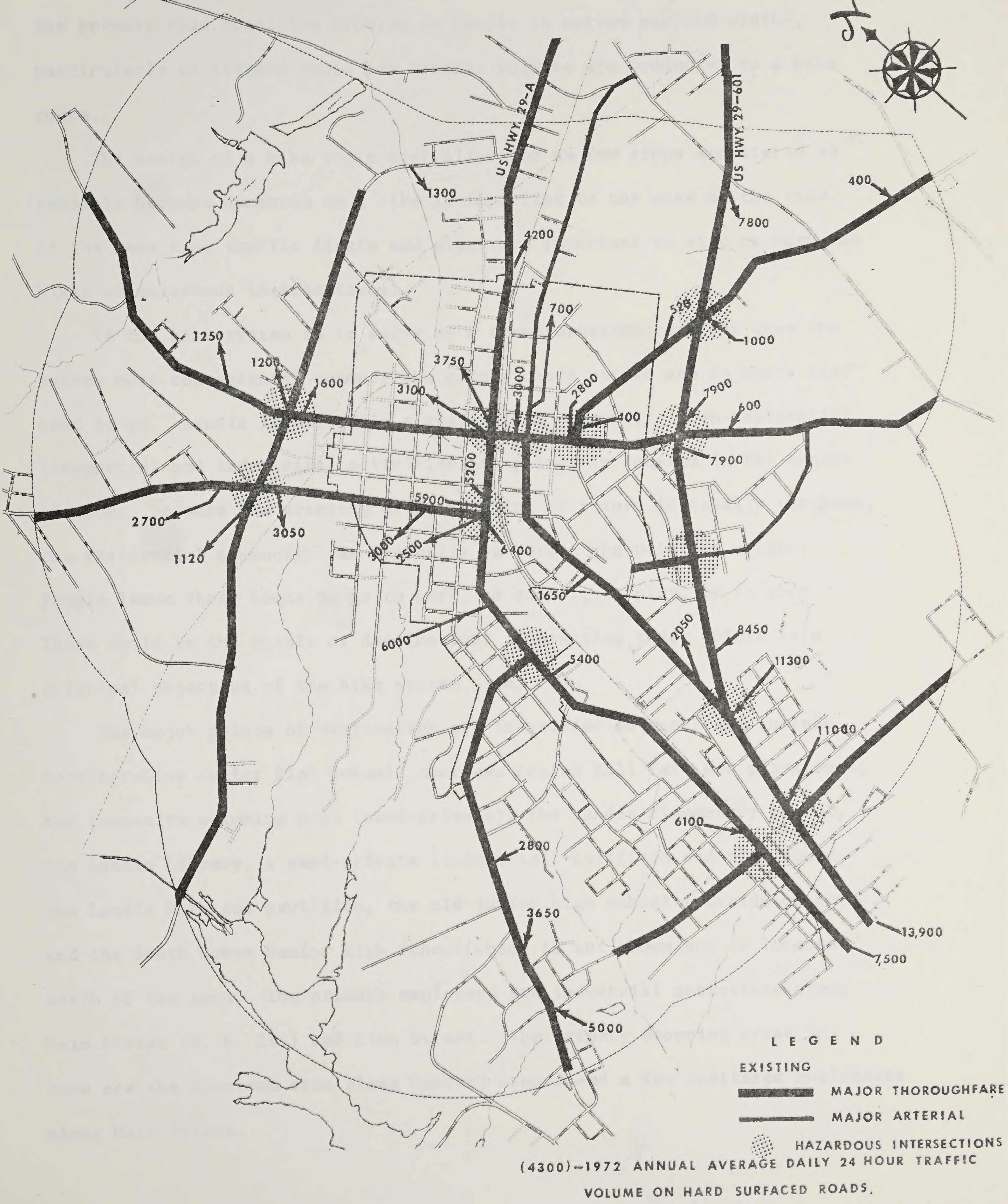
The Bike System Plan must be designed to fulfill the user requirements of cyclists in the Town of Landis with consideration of such existing conditions as traffic volumes and hazardous intersections, road conditions, traffic lights and signs and points of origin and destination. Conditions adverse to cycling must be minimized and favorable conditions must be developed. The system design must be economically feasible and be worthwhile to the cyclist as both a transportation route and recreation facility.

Design Considerations

There are approximately 15.44 miles of streets within the corporate limits of the Town of Landis. Areas of heavy traffic volume include Main Street (U. S. 29A), East and West Ryder Avenue, Chapel Street, Beaver Street, and Rice Street (Map 1). These arterials must be eliminated from use as bike movement corridors because of potential bike-motor vehicle conflict. Likewise the intersection of these arterials must be avoided in the design of a bike system (Map 1). Unfortunately there are points where bike routes must cross these arterials. The majority of bike-motor vehicle accidents occur at intersections. At these points every effort must be made to caution the biker and the motorists of potential dangers.

Road conditions are important to the biker because he is likely to physically feel poor road conditions. Streets that are unpaved, paved and potted, have numerous grade separations, or are steep in grade prove difficult if not hazardous. Fortunately only 0.9 miles of the Landis street system are unsurfaced and these streets are scheduled for improvements. Road

TRAFFIC VOLUME
AND
HAZARDOUS INTERSECTIONS
LANDIS, N.C.



MAP 1

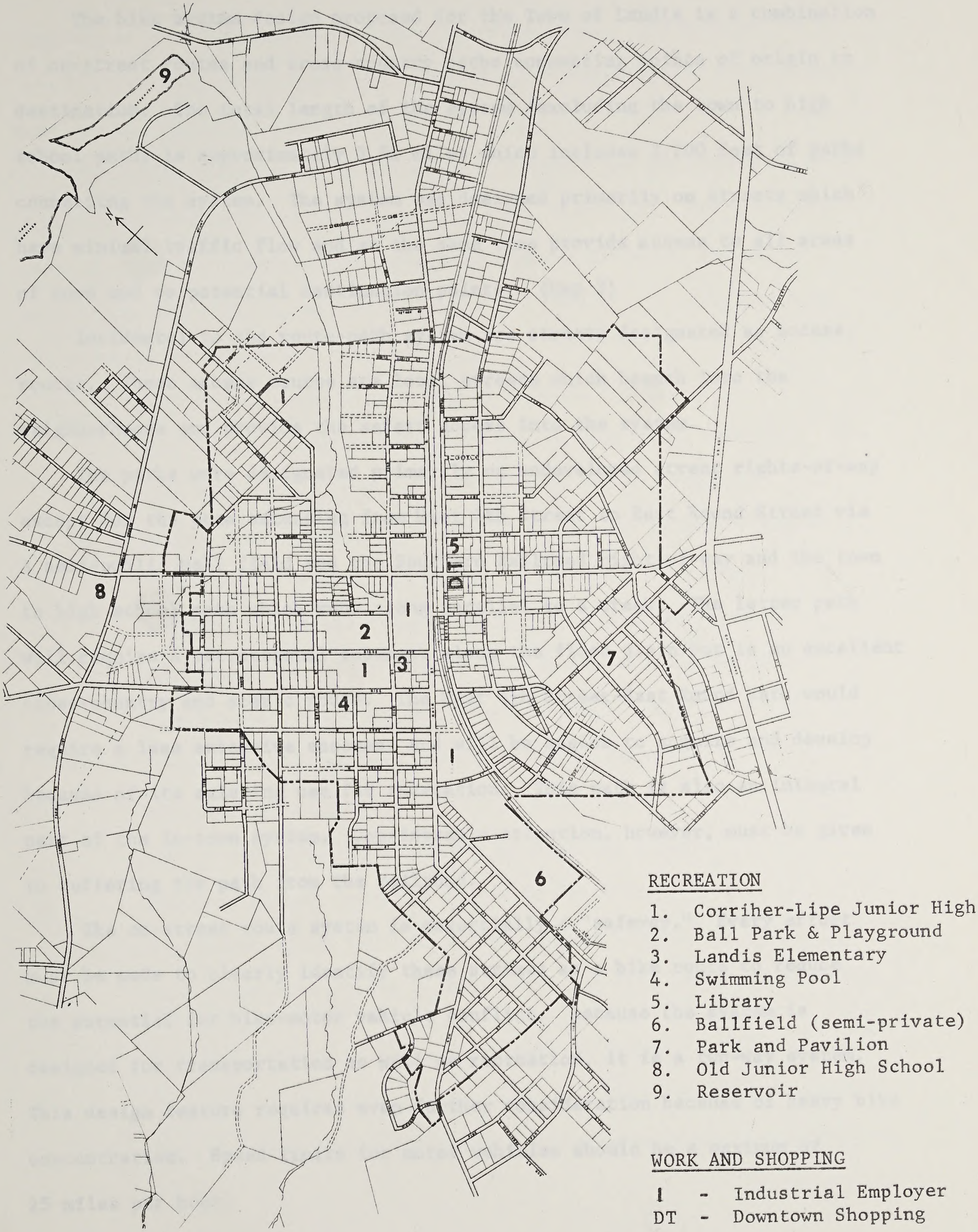
conditions in Landis are generally excellent with few pot holes or grade separations. Few, if any, streets in Landis are excessively steep in grade. The primary road condition problem in Landis is narrow surface widths, particularly on streets whose low traffic volumes are conducive to a bike route.

The design of a bike route must allow for as few stops and starts as feasible because momentum on a bike is important to the ease of the ride. At the same time traffic lights and signs are important to stop or warn the biker at hazardous intersections.

If the bike system is to serve as a transportation corridor then the system must conveniently connect the points where people are to where they want to go. Landis is basically a residential community. Non-residential (commercial and industrial) activities are primarily located in the center of town. Because the starting point or point of return is usually the home, the residential community can logically be termed the point of origin. People leave their homes to go to work, to school, to play, or to shop. These would be the points of destination. Connecting these points is a principal objective of the bike system plan.

The major points of destination are identified on Map 2 and include Corriher-Lipe Junior High School, American Legion Ball Park and playground, the community swimming pool (semi-private), the Landis Elementary School, the Landis Library, a semi-private (industrial) ballfield and playground, the Landis Park and pavillion, the old junior high school (outside of town), and the South Rowan Senior High School which is not shown but is located north of the town. The primary employers are industrial activities along Main Street (U. S. 29A) and Zion Street. The primary shopping areas in town are the downtown area along Central Avenue and a few scattered businesses along Main Street.

DESTINATION POINTS



RECREATION

1. Corriher-Lipe Junior High
2. Ball Park & Playground
3. Landis Elementary
4. Swimming Pool
5. Library
6. Ballfield (semi-private)
7. Park and Pavilion
8. Old Junior High School
9. Reservoir

WORK AND SHOPPING

I - Industrial Employer
DT - Downtown Shopping

MAP 2

The Bike System Design

The bike system design proposed for the Town of Landis is a combination of on-street routes and cross-country paths connecting points of origin to destination. The total length of the system (excluding the town to high school path) is approximately 5.92 miles which includes 2,200 feet of paths connecting the system. The system was designed primarily on streets which have minimal traffic flow and at the same time provide access to all areas of town and to potential destination points. (Map 3)

Incidental to the route-path system are streets designated as access routes. These access routes are local streets which branch into the neighborhoods and provide the safest access into the system.

The paths were designated primarily on undeveloped street rights-of-way except for the path extending from West 4th Street to East Round Street via a semi-public ball field and the Southern Railroad right-of-way and the town to high school path which runs along parallel to a creek. The latter path will require a recreational easement along the flood plain but is an excellent cross-country and scenic route. The West 4th Street-East Round path would require a less extensive easement and will be easier to acquire and develop because of its existing use for recreation. This path is also an integral part of the in-town system. Considerable attention, however, must be given to buffering the path from the railroad.

The on-street route system is essentially a "safeway." Every effort must be made to clearly identify these streets as a bike route to reduce the potential for bike-motor vehicle conflict. Because the system is designed for transportation as well as recreation, it is a two-way system. This design feature requires even further consideration because of heavy bike concentration. Speed limits for motor vehicles should be a maximum of 25 miles per hour.

Because of the relative narrowness of existing local streets the separate or even designated bike lane is impractical. The elimination of on-street parking along these routes would substantially free traffic movement for the bike and motor vehicle.

The Landis Bike System is essentially a bypass design connecting major parts of the community without traveling along arterials. The residential areas of town are connected to the downtown area, the major industrial activities, the schools, and recreation areas (Map 3). A description of the route is as follows:

West Garden (from Zion Street to Kimmons Street)

Zion Street (from West Ryder Avenue to West Ridge Street)

West Ridge Street (from Zion Street to Meriah Street)

South Kimmons Street (from West Ryder Avenue to Hoke Street)[1]

Hoke Street (from Meriah Street to South Valley Street)

South Valley Street (from Hoke Street to West 2nd Street)

West 2nd Street (from South Valley Street to Zion Street)

Zion Street (from West 2nd Street to Davis Street)

Davis Street (from Zion Street to Poplar Street)

Poplar Street (from Davis Street to 6th Street)

6th Street (from Poplar Street to Highland Street)

Highland Street (from 6th Street to 4th Street)

4th Street (from Highland Street to Main Street)[2]

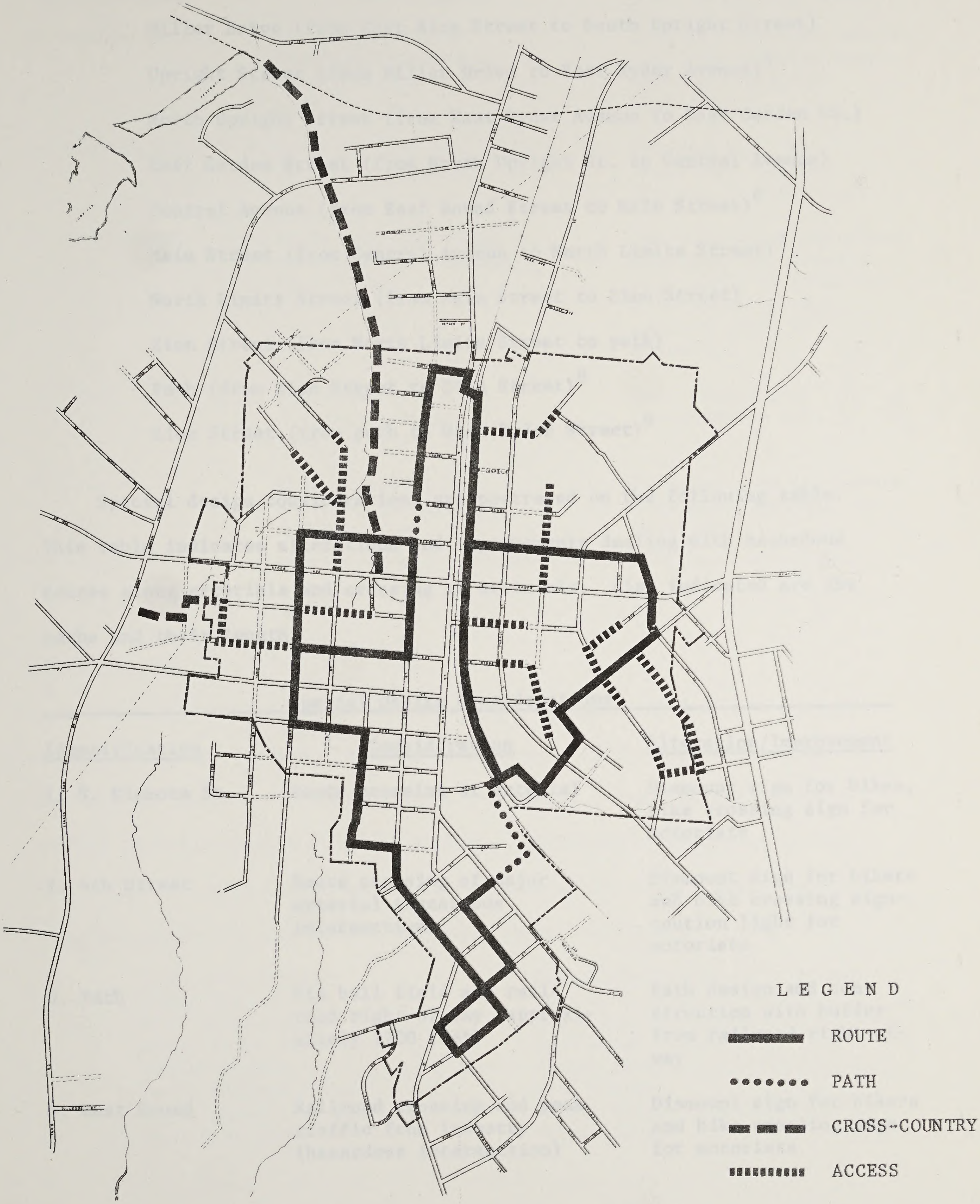
Path (from Main Street to East Round via ball field and Southern Railway right-of-way)[3]

East Round Street (from path to Central Avenue)[4]

Hillside Street (from Central Avenue to East Corriher Street)

East Corriher Street (from Hillside Street to East Rice Street)

LANDIS BIKE SYSTEM



MAP 3

East Rice Street (from East Corriher Street to Miller Drive)

Miller Drive (from East Rice Street to South Upright Street)

Upright Street (from Miller Drive to East Ryder Avenue)[5]

North Upright Street (from East Ryder Avenue to East Garden St.)

East Garden Street (from North Upright St. to Central Avenue)

Central Avenue (from East Round Street to Main Street)[6]

Main Street (from Central Avenue to North Limits Street)[7]

North Limits Street (from Main Street to Zion Street)

Zion Street (from North Limits Street to path)

Path (from Zion Street to Zion Street)[8]

Zion Street (from path to West Ryder Street)[9]

Special design considerations are portrayed on the following table. This table indicates alterations and improvements dealing with hazardous routes along arterials and crossing at arterials. Also indicated are the paths and their length.

Special Design Considerations

Identification	Consideration	Alteration/Improvement
1. S. Kimmons St.	Route crossing at arterial	Dismount sign for bikes, bike crossing sign for motorists
2. 4th Street	Route crossing of major arterial (hazardous intersection)	Dismount sign for bikers and bike crossing sign-caution light for motorists
3. Path	Via ball field and railroad right-of-way (approximately 1700 feet)	Path design and construction with buffer from railroad right-of-way
4. East Round	Railroad crossing and peak traffic from industry (hazardous intersection)	Dismount sign for bikers and bike crossing sign for motorists

Identification	Consideration	Alteration/Improvement
5. Upright St.	Route crossing of arterial (hazardous intersection)	Dismount sign for bikers and bike crossing sign-caution light for motorists
6. Central Ave.	Downtown area and library (moderate traffic)	Warning sign for motorists, parking facilities for bikers
7. Main Street	Route for 400' along arterial and crossing of arterial	Separate bike lane along right-of-way, dismount sign along at crossing, bike crossing sign-caution light for motorists
8. Path	Via unimproved Zion St. right-of-way (approximately 500')	Path design and construction
9. Zion St.	Route crossing of arterial (hazardous intersection)	Dismount sign for bikers, bike crossing sign for motorists

Access Routes

The access routes are primarily designated access points into the bike system. They are designed to carry bike movement from residential areas that are not immediately accessible to the system. Signs indicating these streets as access routes would be helpful. Education of bikers as to the best points of entry to the system along these access routes could possibly be a less expensive alternative (Map 3). These streets are:

West Mill Street
South Deal Street
West Ridge Avenue
South Vance Street
Meriah Street
North Kimmons Street
South Correll Street
East Rice Street
East Ridge Avenue
East Mill Street
North Correll Street
East Ridge Avenue
Taylor Street
Deal Street
Beaver Street
Turner Street

Cross Country Paths

There are two paths reaching out of the Town of Landis. The largest is the path from West Garden Street via the creek and the reservoir to South Rowan Senior High School. The second path stretches from the town limits at West Mill Street via unimproved road rights-of-way to the old junior high school. These two paths should be coordinated with a county-wide bike system and become integral parts of any future cross-country system. (Map 3)

Design Implementation

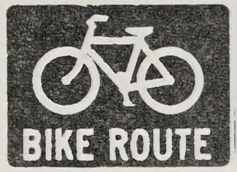
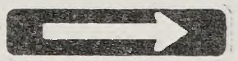
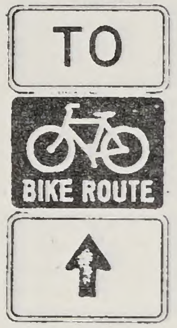
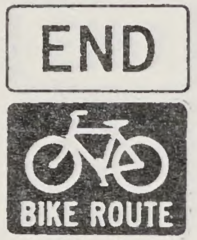
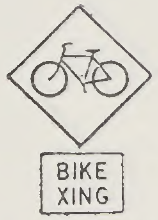
This design system is merely a paper plan until the necessary components or alterations and improvements are developed. These components include route direction signs, dismount signs, motorists-caution signs-lights, street markings, path construction, separate lane construction, and parking facilities. The more expensive items such as path and separate lane constructions and parking facilities can be staged over a period of time. The route signs and warning signs are prerequisite to the implementation of the system.

Signs - Signs are used to impart information about direction and hazards. The recommended number of signs indicating the direction of the path is 10* per mile. The system is 5.92 miles. The necessary number would be approximately 60 signs.

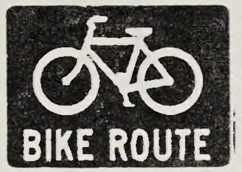
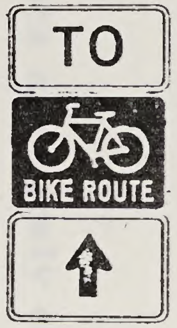
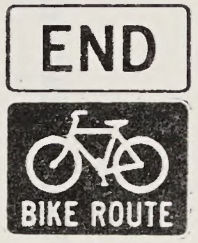
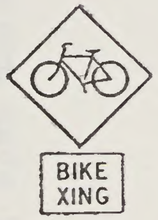
Signs warning motorists of a bike crossing should be placed wherever the route crosses an arterial street. At both crossings of Main Street (U. S. 29A) and on both crossings of Ryder Street these warning signs should include a sign and a flashing light. All streets, except East Round Street

*The North Carolina Bike Facility and Program Handbook

BIKEWAY SIGN CHARACTERISTICS AND STANDARDS

Sign Type	Sign	Purpose	Status	Size[1]	Legend[2]	Materials[3]	Reflectorization Illumination	Comments
GUIDE		Identification of predetermined route over any safe and suitable surfaces	OFFICIAL; mandatory, as designated in the Manual of Uniform Traffic Control devices (UTCD-D11-1)	24x18"	White on green w/border; 3" Series C letters w/bicycle symbol	variable	not required	Application on all classes of bikeways
		Identification of directional changes in designated route	OFFICIAL; for use as required (UTCD-D11-1)	24x6"	White on green w/border	variable	not required	To be placed directly below BIKE ROUTE sign; application on all classes of bikeways
		Direct bicyclists to BIKE ROUTE from areas where route designation is not possible	for use as required; (UTCD-M4-5, M6-1..7)	TO marker 24x12" BIKE ROUTE 24x18" Directional arrow 21x15"	Black on white w/border White on green w/border Black on white w/border	variable	not required	Might be utilized in high generator areas (e.g. shopping centers, schools) where parking, open space, etc. separates ROUTE from destinations etc.
		Identification of end of safe, suitable ROUTE	for use as required (UTCD-M4-6)	END marker 24x12" BIKE ROUTE 24x18"	Black on white w/border White on Green w/border	variable	not required	Might be utilized w/BEGIN BIKE ROUTE indication having same design characteristics; application on all classes of bikeways
	("BIKE PARKING")	Identification of parking/storage facilities	none	-	-	-	-	Design based on standard "Parking" sign
WARNING		For use in advance of point where official bikeway crosses road	OFFICIAL; for use as required (UTCD-W11-1)	30x30" (diagonal position) 24x18"	black on yellow w/border black on yellow w/border	variable	recommended	Application in conjunction w/all classes of bikeways
	("WATCH FOR BIKES")	For use as supplemental warning w/bikeway identification signs	none	30x30" (diagonal position)	black on yellow w/border	variable	recommended	Application in conjunction w/all classes of bikeways

BIKEWAY SIGN CHARACTERISTICS AND STANDARDS

Sign Tyoe	Sign	Purpose	Status	Size[1]	Legend[2]	Materials[3]	Reflectorization Illumination	Comments
GUIDE		Identification of predetermined route over any safe and suitable surfaces	OFFICIAL; mandatory, as designated in the Manual of Uniform Traffic Control devices (UTCD-D11-1)	24x18"	White on green w/border; 3" Series C letters w/bicycle symbol	variable	not required	Application on all classes of bikeways
		Identification of directional changes in designated route	OFFICIAL; for use as required (UTCD-D11-1)	24x6"	White on green w/border	variable	not required	To be placed directly below BIKE ROUTE sign; application on all classes of bikeways
		Direct bicyclists to BIKE ROUTE from areas where route designation is not possible	for use as required; (UTCD-M4-5, M6-1..7)	TO marker 24x12" BIKE ROUTE 24x18" Directional arrow 21x15"	Black on white w/border White on green w/border Black on white w/border	variable	not required	Might be utilized in high generator areas (e.g. shopping centers, schools) where parking, open space, etc. separates ROUTE from destinations etc.
		Identification of end of safe, suitable ROUTE	for use as required (UTCD-M4-6)	END marker 24x12" BIKE ROUTE 24x18"	Black on white w/border White on Green w/border	variable	not required	Might be utilized w/BEGIN BIKE ROUTE indication having same design characteristics; application on all classes of bikeways
	("BIKE PARKING")	Identification of parking/storage facilities	none	-	-	-	-	Design based on standard "Parking" sign
WARNING		For use in advance of point where official bikeway crosses road	OFFICIAL; for use as required (UTCD-W11-1)	30x30" (diagonal position) 24x18"	black on yellow w/border black on yellow w/border	variable	recommended	Application in conjunction w/all classes of bikeways
	("WATCH FOR BIKES")	For use as supplemental warning w/bikeway identification signs	none	30x30" (diagonal position)	black on yellow w/border	variable	recommended	Application in conjunction w/all classes of bikeways

and Central Avenue are state maintained. Therefore, the warning signs for all arterials would be provided by the N. C. Department of Transportation with two warning signs on East Round Street and four on Central Avenue being provided by the town.

Signs directing bikers to dismount should be erected wherever the route crosses an arterial or railroad and hazardous conditions exist. There are six intersections requiring 12 dismount signs. (The dismount sign is not listed under sign specifications but would use the standard bike symbol with the word DISMOUNT below.)

Separate Lane Construction - Because of a distance of 400 feet along Main Street (U. S. 29A) where the route is directed, bike traffic should be separated from the highway. This will require the construction of a separate bike lane. To accommodate two-way traffic within the Main Street right-of-way, the land should be constructed at the same standards as the bike paths.

Bike Paths - Bike paths are designed to carry two-way traffic. This feature necessitates a minimum width of 8 feet. To insure permanence of the path and low maintenance costs, the paths should contain a 4 inch compacted base and 2 inch bituminous concrete top. Total length of the path system (excluding the old junior high and South Rowan Senior High School routes) is approximately 2200 linear feet.

Design Costs

The enclosed costs are merely estimates. Efforts have been made to reflect current prices but because of existing market conditions the figures cannot be totally reliable.

Signs

Item	Quantity		Unit Cost	Total Unit Cost
Route signs	60	@	$22.00	$1,320
Warning signs	4	@	$22.00	88
Dismount signs	12	@	$22.00	264
				$1,672

Path and Bike Lane Construction

Item	Quantity		Unit Cost	Total Unit Cost Per L. F.
Clearing and grubbing	1 L.F., 8' wide	@	$0.18 per sq. ft.	$0.14
Excavation	8/27 cu. ft. = 0.30 cu. yds.	@	$4.00 per cu. yd.	$1.20
Compacted base	4" thick, 8' wide (0.20 ton per L.F.)	@	$5.00 per ton	$1.00
Asphalt paving	2" thick, 8' wide (0.10 ton per L.F.) 8/9 sq. yd. = 0.9 sq. yd.	@	$22.00 per ton	$2.20
			Subtotal	$4.54
			5.15% engineering and contingency	.68
			Total estimated cost per lineal foot	$5.22
	Path:		Total lineal feet 2200' x $5.22 per L. F.	$11,484
	Lane:		Total lineal feet 400' x $5.22 per L. F.	$ 2,088

Paint for Marking Crossing

20 gallons of paint at $3.50 per gallon	$70.00

Project Estimate Summary

Signs	$ 1,672
Path and lane construction	13,572
Paint	70
	$15,314

These costs can be reduced substantially by using certain alternatives. Using wood posts instead of metal poles can reduce sign costs by half. Clearing and grubbing and excavating paths and filling with base only or

using shredded materials can reduce costs by 50 to 66 percent. These cost reductions can be achieved but the result will be less than an optimum system. If the less expensive course is followed then it should be done with the concept of proceeding with further improvements as funds become available. Another alternative would be to utilize town personnel and volunteer labor to reduce costs as much as possible.

Funding Sources

The Town of Landis should initiate action to acquire state and federal assistance for this project. Bike systems are fundable under a number of programs but few systems have been funded. Possible funding sources would be:

Labor

1. ACTION: volunteer program funded through the Department of Labor, Manpower Administration.
2. National Guard and Reserve Units: units of the National Guard and Army Reserve engineering units will provide labor and machinery on a variety of local projects.

Advisory Assistance

1. Soil Conservation Service, USDA: technical assistance and design relating to soil, drainage and stabilization.
2. Extension Service, USDA: technical assistance relating to landscaping and horticulture.

Construction

1. Bureau of Outdoor Recreation, Dept. of Interior: project grants for acquisition and development of outdoor recreation areas for which other Federal funding is not available. Eligible projects include bicycle paths and routes.

2. Department of Housing and Urban Development: through the Community Development Block Grant program a variety of recreation programs are fundable. However, funds are very limited and for other than "hold harmless" cities give priority to housing related activities.
3. Department of Housing and Urban Development: grants available up to 100 percent of cost to help communities acquire and develop land as permanent open space.
4. Farmers Home Administration: a variety of subsidized loans are available to small towns and rural recreation associations for recreation projects.

In projects such as a bike system the participation of community groups and associations is not only advantageous economically, but also by encouraging strong community participation. Industrial assistance in project funding should also not be overlooked.

PART III

ENCOURAGING BIKE USE

The establishment of a safe, convenient and enjoyable bike system will go a long way in encouraging bike use. There are, however, certain other considerations which will further encourage safe bike use.

Parking Facilities

The ability to leave a bike at a location and be assured it will be there on return is a tremendous factor in bike use. Unless facilities are available for parking, then the bike user is reluctant to ride the bike to a location he intends to be at for any length of time.

Generally schools do have parking facilities. Schools in Landis should be surveyed for the existence, adequacy, and use of bike racks. Many types provide little protection and are therefore seldom used. The same would be true of recreation areas in the community.

Parking facilities of adequate quality should be provided at industrial plants to encourage employees to travel by bike. The downtown merchants should acquire parking facilities for their customers. A parking facility should also be located at the Municipal Building particularly for library patrons.

Thefts and Loss

Chief Eric Jones of the Landis Police Department reports that the recovery rate for reported lost and stolen bikes is good. A required Bicycle Registration Program and Ordinance could be helpful in further reducing the number of lost and stolen bikes. A proposed ordinance is attached in the appendix.

Safety Program

A major part of bike safety is providing safe places to ride. As important as safe routes are safe riders. Landis is indeed fortunate not to have had any fatalities from bike-motor vehicle accidents. Hopefully the bike system will help in continuing that excellent record.

Chief Jones has conducted bike safety programs sponsored by the American Legion and the Boy Scouts. Many more programs are needed, especially if a bike system is implemented. A bike safety ordinance would also be helpful in encouraging safer bike use. A proposed ordinance is attached in the appendix.

APPENDIX

Stopping Sight Distances

The degree of safety which a bikeway offers relates in part to how easily conflicting cross-movements are perceived, whether they be pedestrians, other bicyclists, automobiles or animals. However, the ability of a bicyclist to react to specified cross movements is dependent on the stopping sight distance that is provided. Safe stopping sight distances are a function of bicycle speed and the grade profile of the facility. The following table summarizes recommended stopping sight distances for various design speeds and gradients as developed by the American Association of State Highway and Transportation Officials.

DESIGN STOPPING SIGHT DISTANCES FOR BICYCLES

	Stopping sight distances for downhill gradients of:			
Design Speed	0% (feet)	5% (feet)	10% (feet)	15% (feet)
10 mph	50	50	60	70
15 mph	85	90	100	130
20 mph	130	140	160	200
25 mph	175	200	230	300
30 mph	230	260	310	400

Note: Design values for stopping sight distance on bikeways can be developed in the same manner as on highways. The values shown in this table were based on the following factors and developed by AASHTO:

coefficient of skid resistance = 0.25
perception-reaction time = 2.5 seconds
eye height = 3.75 feet
object height = 6 inches

SOURCE: The North Carolina Bicycle Facility and Program Handbook

PARKING FACILITY LOCATIONAL CRITERIA

Activity Area	Length of Storage Time	Night-time Use	Degree of Security Required	Standard Framework for Determining Number of Parking Spaces
Grade Schools	5 to 8 hours	Low	High	Percent of student body
Universities	1 to 15 hours	High	Moderate	Percent of student body, percent of classroom spaces
Regional Shopping Centers	2 hours	High	Moderate	Percent of auto parking spaces
Convenience Shopping Centers	0.5 hours	Moderate	Low to Moderate	Percent of auto parking spaces
Central Business Districts	1 to 9 hours	Low	Moderate	Percent of auto parking spaces
Single Large Employer	8 hours	Variable	High	Percent of employees, percent of auto parking spaces
Public Buildings				
- Libraries	5 min. to 2 hours	Moderate	Moderate	Percent of facility users
- Post Offices	5 to 15 min.	Low	Low	
- Municipal Offices	2 to 4 hours	Low	Moderate	
- Hospitals	30 to 90 min.	Moderate	Moderate	
Regional Parks	1 to 8 hours	Low	Variable	Percent of facility users
Neighborhood Parks	1 to 3 hours	Low	Variable	Percent of facility users
Single Recreational Activity (such as swimming pools)	1 to 5 hours	Moderate	Variable	Percent of facility users on given day

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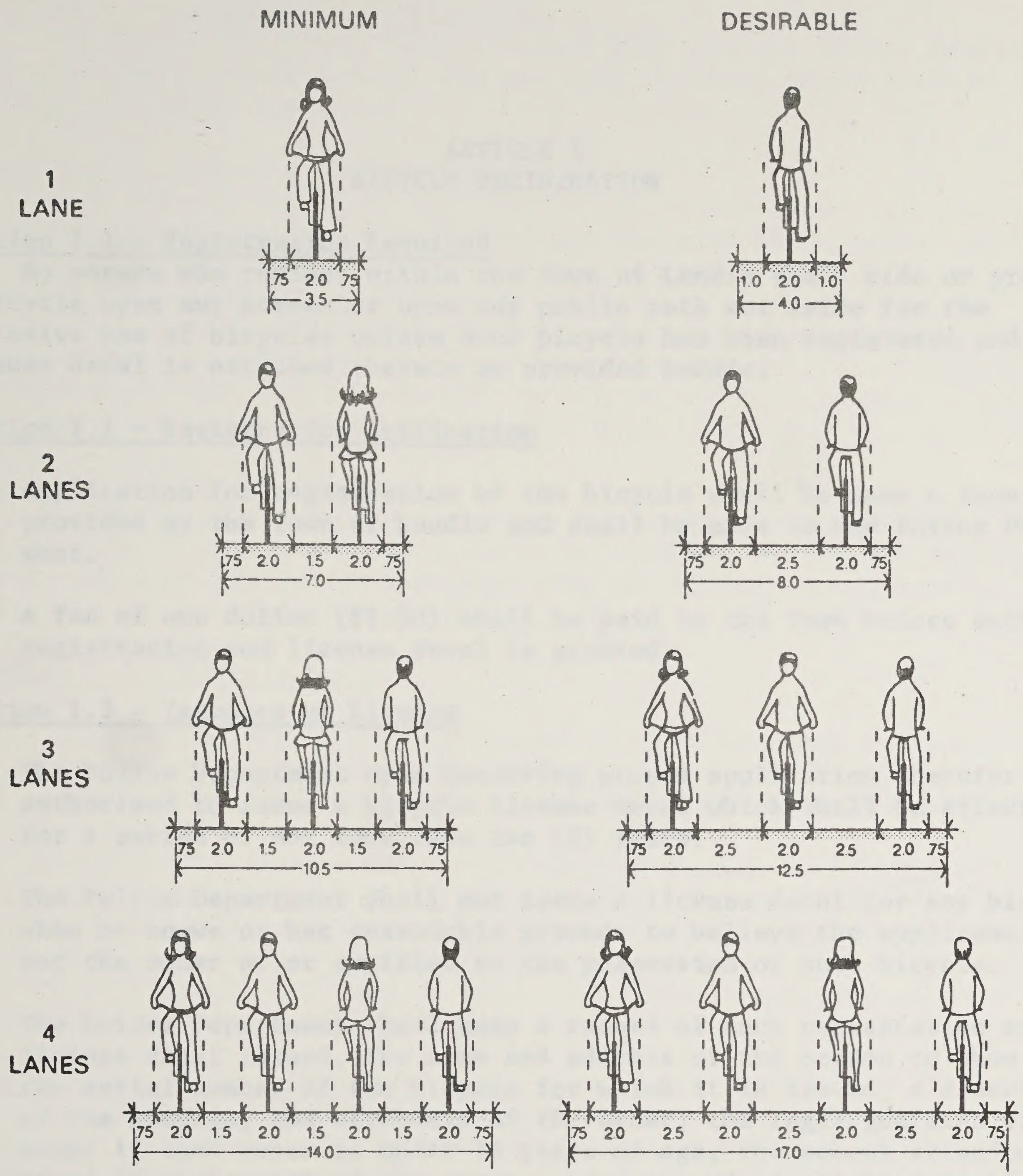
[1] A function of the length of time bicycle is to be stored and the activity surrounding the storage area

SOURCE: The North Carolina Bike Facility and Program Handbook



MINIMUM AND DESIRABLE BIKEWAY PAVEMENT WIDTHS

SOURCE: The North Carolina Bike Facility and Program Handbook

BICYCLE REGISTRATION ORDINANCE FOR

LANDIS, NORTH CAROLINA

ARTICLE I
BICYCLE REGISTRATION

Section 1.1 - Registration Required

No person who resides within the Town of Landis shall ride or propel a bicycle upon any street or upon any public path set aside for the exclusive use of bicycles unless such bicycle has been registered and a license decal is attached thereto as provided herein.

Section 1.2 - Registration Application

(a) Application for registration of the bicycle shall be upon a form provided by the Town of Landis and shall be made to the Police Department.

(b) A fee of one dollar ($1.00) shall be paid to the Town before each registration and license decal is granted.

Section 1.3 - Issuance of License

(a) The Police Department upon receiving proper application therefor is authorized to issue a bicycle license decal which shall be effective for a period of not more than two (2) years.

(b) The Police Department shall not issue a license decal for any bicycle when he knows or has reasonable grounds to believe the applicant is not the owner of or entitled to the possession of such bicycle.

(c) The Police Department shall keep a record of each registration and license decal issued, the name and address of the person to whom issued, the serial number of the bicycle for which it is issued, a description of the bicycle, the birthdate of the owner, the legal guardian of the owner if such owner is under 18 years of age, the school attended or place of employment of the owner, and a record of all bicycle license fees collected.

Section 1.4 - Attachment of License Decal

(a) The Police Department, upon registering a bicycle, shall also issue a decal bearing a unique number assigned to the bicycle, the name of the Town and the calendar years for which it is issued.

(b) The Police Department shall cause such decal to be firmly attached to the frame of the bicycle, in such position as to be plainly visible.

(c) No persons shall remove a license decal from a bicycle during a period for which issued except upon a transfer of ownership or in the event the bicycle is dismantled or no longer operated upon any streets in this Town.

Section 1.5 - Inspection of Bicycles

The Police Department shall inspect each bicycle before registering same and shall refuse a decal for any bicycle which he determines is in unsafe mechanical condition.

Section 1.6 - Renewal of Registration

Upon the expiration of any bicycle registration the same may be renewed upon application and payment of the same fee upon the original application.

Section 1.7 - Transfer of Ownership

Upon the sale or the transfer of a registered bicycle the registrant shall remove the decal and shall either surrender the same to the Police Department or may upon proper application but without payment of additional fee have said decal assigned to another bicycle owned by the applicant.

Section 1.8 - Rental Agencies

A rental agency shall not rent or offer any bicycle for rent unless the bicycle is registered and a decal is attached thereto as provided herein and such bicycle is equipped with all equipment required by this ordinance or the State Vehicle Code.

Section 1.9 - Bicycle Dealers

(a) Every person engaged in the business of selling new or second hand bicycles shall register said bicycle as required herein and shall provide a record to the Police Department of all such registrations.

(b) Every person engaged in the business of buying or selling new or second hand bicycles shall make a report to the Police Department of every bicycle purchased or sold by such dealer, giving the name and address of the person from whom purchased or to whom sold, a description of such bicycle by name or make, the frame number thereof, and the number of license deal, if any, found thereon.

Section 2.0 - Effect of Regulations

Any person violating any provision of this article shall be found guilty of a misdemeanor. The Police Department or any of the members thereof may impound or retain possession of any bicycle operated in violation of any of the provisions in this article and retain possession of the same until the registration provided for herein is obtained by the owner of the bicycle.

ORDINANCE REGULATING BICYCLE USE

LANDIS, NORTH CAROLINA

ARTICLE I
REGULATIONS FOR BICYCLES

Section 1.1 - Traffic Laws Apply to Persons Riding Bicycles

Every person riding a bicycle upon a roadway shall be granted all of the rights and shall be subject to all of the duties applicable to the driver of a vehicle by this ordinance, except as to special regulations in this article and except as to those provisions of this ordinance which by their nature can have no application.

Section 1.2 - Riding on Roadways and Paths

(a) All regulations applicable to bicycles shall apply whenever a bicycle is operated upon any street or upon any public path set aside for the exclusive use of bicycles, subject to those exceptions stated herein.

(b) The operator of a bicycle upon entering a bicycle route or path shall yield the right-of-way to all bicycles approaching upon sail route or path, and upon entering the roadway, shall yield the right-of-way to all vehicles and bicycles in said roadway.

(c) Any bicycle being operated on a public roadway shall yield to the right on audible signal when overtaken by another vehicle. The driver of a vehicle overtaking a bicycle proceeding in the same direction shall pass to the left thereof at a safe distance, and shall not again drive to the right side of the roadway until safely clear of the overtaken bicycle.

Section 1.3 - Riding on Sidewalks

(a) The Chief of Police is authorized to erect signs on any sidewalk prohibiting the riding of bicycles thereon by any person and when such signs are in place no person shall disobey the same.

(b) Whenever any person is riding a bicycle upon a sidewalk such person shall yield the right-of-way to any pedestrian and shall give audible signal before overtaking and passing such pedestrian.

Section 1.4 - Turning Movements

(a) When completing a left turn on two-way roadways, bicyclists shall merge to the portion of the roadway nearest the centerline thereof and shall negotiate the left turn so as to enter the intersecting roadway near the right side of the centerline, giving right-of-way to all vehicles proceeding through the intersection in the opposite direction.

(b) When completing a right turn, motor vehicles shall yield the right-of-way to bicycles crossing the intersecting roadway or completing a right turn.

(c) All vehicles or bicycles making turns at intersections shall not proceed into the intersection nor make such a turn without first yielding the right-of-way to all bicycles or other vehicles within or approaching said intersection and shall proceed only when it is safe to do so.

(d) A bicyclist may also negotiate a left turn by dismounting the bicycle and crossing as a pedestrian, leading the bicycle to the other side of the intersecting roadway, and hence to the other side of the traffic roadway. When said person dismounts from a bicycle such person shall then obey the regulations applicable to pedestrians.

(e) A bicyclist shall obey all signs, lights and markings directing his safe movement. Operators of motor vehicles shall heed all bicycle caution and warning signs.

Section 1.5 - Riding on Bicycles

(a) No person operating a bicycle shall carry any package, bundle, or article which prevents the driver from keeping at least one hand upon the handle bars.

(b) A person propelling other bicycles shall not ride other than upon or astride a permanent or regular seat attached thereto.

(c) No bicycle shall be used to carry more persons at one time than the number for which it is designed or equipped.

Section 1.6 - Bicycle Acrobatics

(a) No person riding upon any bicycle shall attach the same or himself to any vehicle upon a roadway.

(b) No rider of any bicycle shall remove both hands from the handlebars, or feet from the pedals, or practice any acrobatic or fancy riding on any street; nor shall any person operating a bicycle upon a street participate in any race or speed or endurance contest with any other bicycle or vehicle, unless said street has been temporarily set aside for such purposes.

Section 1.7 - Bicycle Equipment

(a) Every bicycle shall be equipped with a lamp on the front which shall emit a white light visible from a distance of at least 500 feet to the front and with a red reflector on the rear which shall be visible from all distances from 50 to 300 feet to the rear when directly in front of lawful upper beams of headlamps of a motor vehicle. Every bicycle shall also be equipped with side and pedal reflectors.

(b) Every bicycle shall be equipped with a brake which enables an operator weighing 150 pounds to stop the bicycle within 15 feet at approximately 10 miles per hour.

(c) Every bicycle shall be equipped with a bell or horn audible for a distance of at least 100 feet. No bicycle shall be equipped with a siren or a whistle.

(d) Any bicycle operated on any public roadway, sidewalk, or bikeway from a half hour after sunset to a half hour before sunrise and at any other time when there is not sufficient light to render clearly discernable persons or vehicles at a distance of 500 feet ahead shall display lighted lamps and illuminating devices as required by this article.

(e) Every bicycle which is not free-wheeling shall be equipped with a chain guard.

(f) Every bicycle shall be maintained so as not to endanger the safety of the rider.

Section 1.8 - Effect of Regulations

(a) It is a misdemeanor for any person to do any act forbidden or fail to perform any act required in this article.

(b) The parent of any child and the guardian of any ward shall not authorize or knowingly permit any such child or ward to violate any of the provisions of this ordinance.

(c) Where this chapter has been violated by a juvenile, in lieu of fines and imprisonment and in lieu of filing charges in juvenile court, the Chief of Police or his duly appointed representative may require any of the following or any combination thereof:

1. Attendance at traffic school for a period of three days.
2. Impoundment of bicycle for a period not to exceed 10 days.
3. Inspection of bicycle equipment at the Police Department within two days of any equipment violation.
4. Appearance at once before a peer traffic court.
5. Composition of not less than 200 words on a subject title specified by the Chief of Police or his representative.
6. Participation in bikeway related service for a period of five days.

Total of 149 respondents

LANDIS BICYCLE QUESTIONNAIRE

Please answer all questions. You may give more than one answer for the multiple-choice questions.

1. Do you own a bicycle? Yes 138 (95.3%) No 11 (4.7%)

2. Where do you live? Zion, Rankin, Central, Correll, Ridge, Main, Turner, Limits, 5th, Chapel, Dial, Meriah, Garden, Hoke, Beaver, Kimmons, Valley, Upright, Round, Taylor, Blume, Everhardt, Dogwood, Linn, Corriher Heights, 1st, Vance

3. For what purposes do you use your bicycle?
(95.3%) 138 Pleasure trips (17.5%) 26 Shopping
(14.1%) 21 Home to school (6.7%) 10 Home to work, school to work, etc.

4. What are the main places you take your bicycle to?
(14.1%) 21 Park
(10.7%) 16 Elementary school
(42.3%) 63 Downtown
(13.4%) 20 Junior high school
Other: high school, store, anywhere, tennis courts, pool, pavillion, friends,
Other: relatives, Kannapolis Dairy Bar, church, library, woods, pond, playground, post office, parking lot, dirt road

5. What is the average one-way distance you travel for:
a. Pleasure trips? Two blocks - 15 miles
b. Home to school trips? 2/10 miles - 5 miles
c. Shopping? Three blocks - 2 miles
d. Home to work, school to work? One block - 2 miles

6. On what 5 streets do you most often travel by bicycle?
a. Ridge, Rice, Main, Kimball, Chapel, Central, Mt. Moriah, Turner, Zion, Correll,
b. Beaver, Ryder, Mill, Upright, Dial, Taylor, Kimmons, 5th, Hoke, Cannon Farm Rd.,
c. Lentz, Valley, Coldwater, Round, Limit, Blume, Davis, Poplar, 6th, Airport Rd.,
d. Everhardt, Rankin, Dogwood, Old Beatty Ford Rd., Old Concord Rd., Moose Rd.,
e. Bonita, 1st, Landis Rd., Walker, Mooresville Hwy.

7. Where are the most significant points of conflict between you as a cyclist and automobiles?
a. Careless & reckless drivers, cursing, honking horns, being run off road, no
b. room, where sidewalk ends, narrow roads, steep shoulders, hills, intersections,
c. stop signs & lights, downtown, Main, Central, Ryder, Beaver, Chapel, Zion

8. At what times during the day do you most often use your bicycle?
(14.1%) 21 Early morning
(50.4%) 90 Midmorning to late afternoon
(61.7%) 92 Evening

9. Do you ever travel beyond the Landis town limits on your bicycle? Yes 87 (58.4%) No 62 (41.6%)

10. Would you use your bicycle more if routes or pathways are set aside? Yes 127 (85.2%) No 22 (14.8%)

11. Would you be interested in joining a bicycle club? Yes 67 (45.6%) No 81 (54.4%)

12. Is your bicycle registered with the Landis Police Department? Yes 9 (3.4%) No 140 (96.6%)

13. How many times a week do you use your bicycle? 1:11 (7.4%); 2:12 (8.1%); 3-5:44 (29.5%)
6-7:57 (38.3%); No set: 24 (16.1%);
never:1 (.7%)

RESOURCES

"North Carolina Bicycle Facilities and Program Handbook"

Mr. Paul Williams, City Engineer, City of Salisbury

Mr. Curtis Yates, Bicycle Coordinator, N. C. Department of Transportation

Mr. Eric Jones, Police Chief, Landis Police Department

Mr. Charles Kluttz, Jr., N. C. Department of Transportation

Mr. D. L. Miller, Town Clerk, Town of Landis

ENVIRONMENTAL ASSESSMENT STATEMENT

Abstract

A study of existing bike use and a recommended bike system plan to encourage bike use by providing safe and recreational movement corridors for bicyclists.

Environmental Impact

Should the actions be taken as recommended in this study, the environment would definitely be improved. In no way will there be any damage to the environment resulting from actions recommended in this study. The recommended policies are highly coterminous with the Land Development Plan for the area. These policies would also co-mingle with town ordinances designed to improve and preserve aesthetic quality.

Adverse Environmental Effects

No adverse effects are expected from the adoption of the recommendations of this study.

Alternatives to the Proposed Recommendations

The alternative to the adoption of the suggested policies is not to take any planned and coordinated action concerning development of a bike system. Such an alternative would continue biking on open highways and undesignated street systems and deny bikers a safer and more enjoyable bike transit.

Relationship, Under the Proposed Recommendations, Between Local Short Term Uses of Man's Environment and the Maintenance and Enhancement of Long Term Productivity

Adoption of the proposed recommendations of this study will have the same type of effect on both short term and long term use of the environment. This effect will take the form of improved bike transit through the community and should have a more pronounced effect on the long term productivity.

Any Irreversible or Irretrievable Commitments of Resources Which Would Be Involved if the Recommendations are Accepted

There should be no commitment of resources that would be termed irretrievable or irreversible due to actions taken recommended in this study.

Federal or State Policies Which Offset Any Adverse Environmental Effects of the Recommended Actions

Absolutely no adverse effects on the environment are expected if the recommendations set forth are followed. Only beneficial effects can result from such action.

Applicable Federal, State, and Local Environmental Controls

Applicable federal, state and local environmental controls that will lend themselves effectively to the implementation of this study would primarily be the Rowan County Sedimentation Control Ordinance and G.S. 113A-50-66: N. C. Sedimentation Pollution Control Act of 1975.

Mitigation Measures Proposed to Minimize the Impact of the Proposed Recommendations

Measures to minimize the impact of the proposed recommendations will not be necessary as the impact of the actions, if taken as recommended, will be beneficial to the community and the environment.

Problems and Objectives Rasied During the Review of the Proposed Recommendations

There were no problems of an environmental nature raised in review of the study's recommendations.